

First record of gall wasp in *Lithocarpus* (Fagaceae) with description of a new *Saphonecrus* species (Hymenoptera: Cynipidae) from China

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Abstract: A new species of inquiline, *Saphonecrus lithocarpi* sp. nov., is described. This species emerged from leaf gall on *Lithocarpus harlandii* (Fagaceae). Diagnosis, distribution, and biology of the new species are included and illustrated. Also a key of Palaearctic *Saphonecrus* species with pronotal carina is given.

Key words: Cynipoidea; inquiline; taxonomy; distribution; biology; key

首次记录于柯属植物的瘿蜂一新种（膜翅目：瘿蜂科）

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摘要: 记述 1 致瘿类瘿蜂新种: 石栎副客瘿蜂 *Saphonecrus lithocarpi* sp. nov.。该种致瘿于壳斗科的东南石栎叶部。本文报道了该新种的鉴别特征、分布和生物学, 同时编制了具有前胸侧脊的种类的检索表。

关键词: 瘿蜂总科; 寄瘿; 分类; 分布; 生物学; 检索表

Introduction

Species of the family Cynipidae (Hymenoptera) are exclusively phytophagous. The most important group of cynipids is gall makers on Fagaceae (tribe Cynipini), but someone are inquilines of these gallswasps (tribe Synergini). Inquilines have retained the ability to modify the gall tissue directly surrounding them into the characteristic nutritive tissue also found in the larval chambers of the gall inducer but they have lost the ability to begin the gall, nevertheless, a few inquiline species are mentioned as gallforming (Abe *et al.* 2011; Liu *et al.* 2012; Bernardo *et al.* 2013). Phylogenetic analyses indicated that cynipid inquilines have

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evolved from gall-making ancestors (Ronquist 1994; Ronquist & Liljeblad 2001).

The inquiline gall wasps fauna of the Eastern Palaearctic and Oriental region is also poorly known. Synergini includes around 170 species (Melika 2006) in nine genera. The *Saphonecrus* Dalla Torre & Kieffer is morphologically similar to genus *Synergus* Hartig in the tribe Synergini of family Cynipidae, but it distinctly differs from the latter by an open radial cell of fore wing and frontal carina between antennal sockets and lateral ocelli weak or absent.

Saphonecrus Dalla Torre & Kieffer, 1910 is represented by 20 species distributed into the northern hemisphere, but only five of them are reported from China: *S. flavitibilis* Wang & Chen, 2010, *S. tianmushanus* Wang & Chen, 2010, *S. sinicus* Belizin, 1968, *S. naiquanlini* Melika, Ács & Bechtold, 2004 and *S. hupingshanensis* Liu, Yang et Zhu, 2012 (Wang *et al.* 2010; Liu *et al.* 2012). The systematic status of the genus has long been considered to be in need of revision (Pujade-Villar & Nieves-Aldrey 1990; Pujade-Villar *et al.* 2003; Melika 2006; Penzes *et al.* 2009) and a recent phylogenetic study based on sequence data indicated the genus to be paraphyletic (Acs *et al.* 2010). The change is not formally published then we report a new species of *Saphonecrus* according to the current definition of the genus.

In this work we describe a species of *Saphonecrus* from China firstly obtained from galls collected in *Lithocarpus harlandii*.

Material and methods

The specimens from China used in this study are from the Hymenoptera Collection, Zhejiang Agricultural and Forest University, Lin'an, China (ZAFU).

We followed the current terminology of cynipid gall wasp morphology (Liljeblad & Ronquist 1998; Melika 2006). Abbreviations for the forewing venation followed Ronquist and Nordlander (1989), cuticular surface terminology followed that of Harris (1979). Abbreviations used here include: F1–F12, first and subsequent flagellomeres; post-ocellar distance (POL) is the distance between the inner margins of the posterior ocelli; ocellar-ocular distance (OOL) is the distance from the outer edge of the posterior ocellus to the inner margin of the compound eye; LOL, the distance between lateral and frontal ocelli. The width of the forewing radial cell was measured from the margin of the forewing to the Rs vein.

Descriptions and measurements were made under a Leica MZ 12.5 stereomicroscope (Wetzlar, Germany), and photos taken by a digital camera (Q-Imaging, Micropublisher 3.3 RTV) attached to a Leica MZ APO stereomicroscope (Wetzlar, Germany) using Synoptics Auto-Montage version 5.0 software.

All type specimens are deposited in the Hymenoptera Collection of ZAFU and UB (University of Barcelona).

Taxonomy

Saphonecrus lithocarp sp. nov. (Figs. 1, 2)

Diagnosis. Species characterized to have the following characters: lateral frontal carinae absent, lateral pronotal carinae present, mesoscutum with distinct short irregular transverse striate, notauli percurrent, mesopleura completely carinated and tarsal claws simples. Morphologically, this species is similar to *S. haymi*, but *S. lithocarp* sp. nov. differs from the

latter by having notauli percurrent and tarsal claws simples. Only three species have simple tarsal claws (*S. excisus* (Kieffer 1904) from India-Bengal, *S. areolatus* Weld, 1926 from Philippines and *S. serratus* Weld, 1926 from Philippines) but in these cases the pronotal carinae is absent; moreover, *S. serratus* have frontal carinae, *S. areolatus* has punctures dorso-posteriorly of fused metasomal terga 2 + 3 and *S. excisus* has the metasoma incised dorsally. *Saphonecrus lithocarp* sp. nov. is also morphologically similar to a recent described species (*S. fabris*); the differences are indicated in the key (see below).

Holotype. ♀, deposited in ZAFU: **China**, Guangdong, Nanling, 113°01'E, 24°53'N, galls collected on 25-VIII-2010, and rearing gall wasps on 11-IX-2010, Rui GUO. **Paratypes.** 12♀, with same labels as the holotype (1♀ paratype deposited in UB).

Length. Female. Body length 2.0 mm. Males unknown.

Color. Head and mesosoma chesnut, darker in some areas; mandibles brownish red with dark brown tips, maxillae and labium dark yellow; antennae and legs pale yellowish; metasoma dark red, chestnut collar around the distal part of the petiole; hypopygium pale red. Wing veins dark yellow.



Figure 1. *Saphonecrus lithocarp* sp. nov. ♀. A. Head and mesosoma, dorsal view; B. Distal part of metasoma with detail of distal punctuation; C. Head and mesosoma, lateral view; D. Tarsal claw; E. Fore wing.

Head (Figs. 1A, C). Head coriaceous to alutaceous, with sparse setae, low face with sparse short setae. Frons, vertex and gena with sparse setae. Head 1.3 times as broad as media high in anterior view and as wide as mesosoma. Gena delicately alutaceous, not broadened behind eye. Clypeus inconspicuous, anterior tentorial pits distinct but small; epistomal sulcus and clypeo-pleurostomal lines indistinct. Lower face with dense irradiating carinae from clypeus, reaching ventral margin of eye and antennal socket. Malar space 0.6 times as long as height of compound eye. Distance between inner margin of compound eye and antennal socket equal to distance between antennal sockets. Head 1.5 times as broad as media long in dorsal view. POL : OOL : LOL = 2.0 : 1.0 : 1.0, diameter of lateral ocellus 0.4. Frons, vertex and occiput coriaceous with some weak carina-rugae before lateral ocelli, lateral frontal carinae absent.

Antenna (Figs. 1A, 2A). Antenna 13-segmented, pedicel nearly 1.9 times as long as broad; F1 1.2 times as long as F2, 1.5 times as long as pedicel; F11 is the longest flagellomere, 2.1 times as long as F10; ratio of scapus, pedicellum and F1–F11 follows: 10 : 8 : 12 : 10 : 11 : 11 : 11 : 10 : 9 : 9 : 8 : 8 : 17.

Mesosoma (Figs. 1A, C). Mesosoma 1.2 times as long as high in lateral view. Pronotum with uniformly dense pubescence, coriaceous dorsally, and with lateral pronotal carina. Mesoscutum longer than its maximum width in dorsal view, with weakly interrupted transversal rugae, interspaces between rugae coriaceous. Notauli complete, wide and deep, slightly broader posteriorly and narrowed down anteriorly, with transversal rugae. Anterior parallel line distinct present, extending to 1/5 of entirely mesoscutum length; median mesoscutal line absent; parapsidal lines absent. Mesopleuron with evenly dense transverse striate. Scutellum slightly wider than longer, rugose with white setae; scutellar foveae separated by wide and elevated central portion. Metapleural sulcus reaching mesopleuron in upper 4/5 of its height. Lateral carinae of propodeum straight and parallel; central propodeal area coriaceous, with setae; lateral propodeal area delicately coriaceous, with relatively dense white setae.

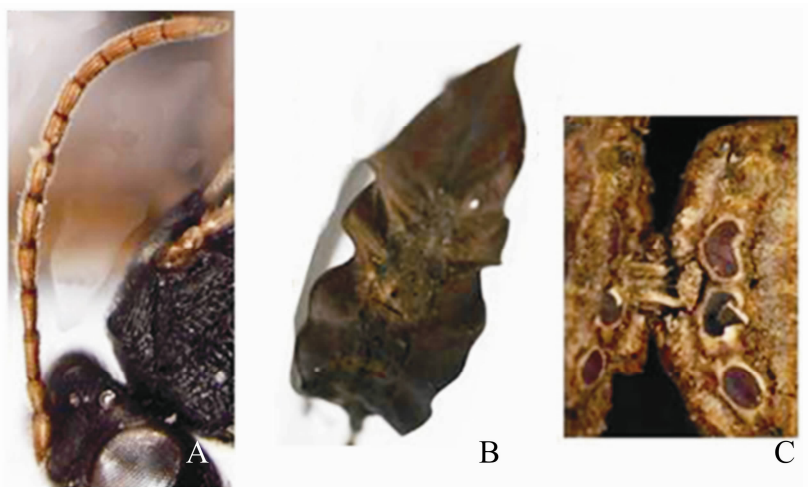


Figure 2. *Saphonecrus lithocarpus* sp. nov. A. Female antenna; B. Gall in leaf of *Lithocarpus lithocarpus*; C. Cut gall.

Legs (Fig. 1D). Tarsal claws simple and without basal lobe.

Fore wing (Fig. 1E). Fore wing margin ciliated; radial cell opened, 2.5–2.6 times as long as broad; areolet absent; vein Rs only slightly curved apically, far away reaching forewing margin as vein R1; vein R1+Sc hardly interrupted before reaching vein R.

Metasoma (Fig. 1B). Fused metasomal tergites 2+3, with few white setae antero-laterally and with punctures postero-apically; hypopygium with very minute dense punctures, ventral ridge with short white setae, prominent part of ventral spine of hypopygium short.

Distribution. China (Guangdong).

Biology. This species usually attacks multilocular galls (Figs. 2B, C) of *Lithocarpus harlandii*. An integral swelling leaf gall, located at the base of the leaf midrib, irregularly shaped. The gall is fleshy, reaching 8–12 mm in diameter, and up to 35 mm in length; the rounded larval chambers, 1–2 mm in diameter; under the laboratory conditions, adults emerged from late September.

Etymology. The species is named after species of its host plant, *Lithocarpus harlandii*.

Discussion

We can separate all the species of *Saphonecrus* into two species groups based on character of pronotal carina (table 1). The new species described here belongs to first group. No key to separate these species have never presented but the most part of species has been described after revision of Dalla-Torre & Kieffer (1910). For this reason we include here a key to differentiate the species with pronotal carina.

Key of Palearctic *Saphonecrus* with pronotal carinae

1. Radial cell of fore wings very short, less than 2.0 times as long as broad *S. irani*
 -. Radial cell longer, more than 2.0 times as long as broad 2
2. Fronts strongly coriaceous with punctate sculpture. Frontal carina present, sometimes very weak 3
 -. Fronts weak coriaceous, alutaceous or almost smooth without punctures. Frontal carina present or not 5
3. Females: antennae 14-segmented, head red. Males: unknown *S. hupingshanensis*
 -. Females: antennae 13-segmented, head dark brown to black. Males: F1 subequal to F2+F3 4
4. Frontal carina weak impressed, median mesoscutal impression reaching 2/3 of mesoscutum length, sometimes obscured by sculpture, radial cell 2.6 times as long as broad, mesopleuron reticulate in the anterior part and between carina, scutellar foveae alutaceous with longitudinal carina, areolet of fore wings present. Females: F1 shorter than F2+F3. Males: lower face and genae yellow, upper face and vertex black, F1 more expanded distally *S. reticulatus*
 -. Frontal carinae strongly impressed, median mesoscutal impression reaching 1/3 of mesoscutum length radial cell 3.3 times as long as broad, mesopleuron without reticulated sculpture between carina. Scutellar foveae without sculpture, areolet absent. Females: F1 subequal to F2+F3. Males: head dark brown, F1 similar expanded distally than basally *S. yukawai*
5. Mesoscutum coriaceous without linear elements, punctuated; tarsal claws simple 6
 -. Mesoscutum with interrupted transversal carinae at least in the anterior part, punctuated or not; tarsal claws with a basal lobe with a tooth or not 7
6. Notauli distinctly impressed, complete, reach the pronotum. Pedicel 2.2 times longer than broad; Females: F1 1.2 times longer than F2; F11 1.9 times longer than F10. Males: F1 1.1 times longer than F2, incised on outer margin, slightly swollen distally; last antennomeres only darker

- *S. shirakashii*
- Notauli short, indistinctly impressed, visible only in the posterior 1/3–1/2 of the mesoscutum. Pedicel 1.6 times longer than broad; Female: F1 1.7 times longer than F2; F11 2.3 times longer than F10. Males: F1 1.5 times F2 or longer, curved and expanded only distally; first antennomeres lighter *S. shirokashicola*
7. Notauli not reaching the posterior margin of pronotum, extending at the least in the posterior half of mesoscutum 8
- Notauli distinctly impressed, complete, reaching the pronotum 10
8. F1 nearly 3.0 times as long as pedicellum. Mesoscutum with strong interrupted transverse rugae. Notauli absent. Radial cell 2.0 times as long as broad. Metasomal terga 2+3 with patch of punctures dorso-posteriorly. Robust specimens (2.0–3 mm) *S. undulatus*
- F1 shorter. Mesoscutum with weak interrupted transverse rugae. Radial cell longer (2.5–3.0 times as long as broad). Metasomal terga without punctures or very obsolete minute punctures postero-apically. Small specimens (less 2.0 mm) 9
9. Larger specimens (1.8–1.9 mm). Antennae with pedicel usually two times as long as wide (always longer than 1.5 times), with similar width in all flagellomeres and last flagellomeres 2.0 times as long as broad. Notauli deep extending in the posterior half of mesoscutum. Metasoma with obsolete sparse minute punctuate postero-apically *S. flavitibialis*
- Small specimens (0.8–1.3 mm). Pedicel subglobose, antennae wider distally and last flagellomeres shorter. Notauli very superficial, un conspicuous extending at the least to 1/2 scutum length or completely absent. Metasoma without punctuation *S. haimi*
10. Parapsidal lines un conspicuous. Mesopleura completely carinated or with smooth spaces reduced. Tarsal claws simple with a basal lobe 11
- Parapsidal lines present reaching to 1/2 of scutum. Mesopleura with smooth areas more or less extended. Tarsal claws with a basal lobe with or without tooth 12
11. Upper face and vertex alutaceous and shiny. Malar space around 0.8 times as long as height of eye. Fused metasomal terga 2+3 smooth, without posterior minute punctures. Females: F1 slightly shorter than 2.0 times the pedicellum length and longer F2. Males: F1 narrow and long, longer than F2 *S. fabris*
- Upper face and vertex coriaceous. Malar space shorter, around 0.6 times as long as height of eye (Figs. 1A, C). Fused metasomal terga 2+3 with posterior minute punctures, limited to small apical dorsal patch. Females: F1 shorter, 1.5 times as long as pedicellum and subequal to F2. Males: F1 wider and short, subequal to F2 *S. lithocarpi* sp. nov.
12. Mesopleuron shiny and smooth; medial mesoscutal line present. Female F1 nearly almost 2.0 times as long as F2 and F11 around 2.0 times as long as F10 *S. diversus*
- Mesopleuron with delicate transverse striae with smooth areas more or less extended; medial mesoscutal line short or impressed at the mainly base of mesoscutum; F1 shorter than 1.5 times F2, F11 shorter 13
13. Mesoscutum without punctures. Mesopleuron reach to the end of mesopleuron in ventral half but upper half posteriorly smooth and shiny. Tarsal claws with a toothed basal lobe. Central area of propodeum between propodeal carinae glabrous. Base of terga 2+3 glabrous, without line of sparse white setae. Female: F1 around 1.3 times as long as F2, F11 around 1.3 times as long as F10. Male: F1 curved and slightly expanded apically, F7–F9 broadest flagellomeres, F10 to F13 narrower *S. naiquanlini*
- Mesoscutum punctuated. Mesopleuron with smooth areas between carinae. Tarsal claws with basal lobe without tooth. Central area of propodeum between propodeal carinae pubescent. Base of terga 2+3 with a line of white setae. Female F1 equal to or slightly longer than F2; F11 around times as long as 1.7 F10. Males unknown *S. tianmushanus*

Table 1. Distribution and important diagnosis characters of all species of *Saphonecrus*

Species	Distribution	Pronotal carinae	Tarsal claws
<i>S. areolatus</i> Weld, 1926	Oriental	Absent	Simple
<i>S. barbotini</i> Pujade-Villar & Nieves-Aldrey, 1985	Western Palaearctic	Absent	With basal lobe
<i>S. brevicornis</i> (Ashmead, 1896)	Nearctic	Absent	With basal lobe
<i>S. brevis</i> Weld, 1926	Nearctic	Absent	With basal lobe
<i>S. chaodongzhui</i> Melika, Ács, and Bechtold, 2004	Eastern Palaearctic	Absent	With basal lobe
<i>S. connatus</i> (Hartig, 1840)	Western Palaearctic	Absent	With basal lobe
<i>S. sinicus</i> Belizin (1968)	Eastern Palaearctic	Absent	With basal lobe
<i>S. excisus</i> (Kieffer 1904)	Eastern Palaearctic	Absent	Simple
<i>S. javanus</i> Weld, 1944	Nearctic	Absent	With basal lobe
<i>S. gallaepomiformis</i> (B de Fonscolombe, 1832)	Western Palaearctic	Absent	With basal lobe
<i>S. gemmariae</i> Ashmead, 1885	Nearctic	Absent	With basal lobe
<i>S. fabris</i> Pujade-Villar Pujade-Villar & Wang, 2014	Eastern Palaearctic	Present	Simple
<i>S. haimi</i> (Mayr)	Western Palaearctic	Present	With basal lobe
<i>S. hupingshanensis</i> Liu <i>et al</i> , 2014	Eastern Palaearctic	Present	With basal lobe
<i>S. irani</i> Melika & Pujade-Villar, 2006	Western Palaearctic	Present	With basal lobe
<i>S. lithocarp</i> sp. nov.	Oriental	Present	Simple
<i>S. flavitibilis</i> Wang et Chen, 2010	Eastern Palaearctic	Present	With basal lobe
<i>S. naiquanlini</i> Melika, Ács, and Bechtold (2004)	Eastern Palaearctic	Present	With basal lobe
<i>S. serratus</i> Weld, 1926	Oriental	Present	Simple
<i>S. shirakashii</i> (Shinji, 1940)	Eastern Palaearctic	Present	With basal lobe
<i>S. shirokashicola</i> (Shinji, 1941)	Eastern Palaearctic	Present	With basal lobe
<i>S. diversus</i> Belizin (1968)	Eastern Palaearctic	Present	With basal lobe
<i>S. tianmushanus</i> Wang et Chen, 2010	Eastern Palaearctic	Present	With basal lobe
<i>S. undulatus</i> (Mayr)	Western Palaearctic	Present	With basal lobe
<i>S. yukawai</i> Wachi, Ide & Abe, 2011	Eastern Palaearctic	Present	With basal lobe

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